

MEDIA ACCESS CONTROL INTERFACE

REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of provisional application of U.S. Ser. No. 60/246,223 filed Nov. 6, 2000.

BACKGROUND

[0002] The International Standards Organization's (ISO's) Open Systems Interconnection (OSI) is an industry standard for communications and networking for open systems. Each of the seven layers specifies particular network functions:

[0003] Layer 7, the application layer, the highest layer of the model, defines the way applications interact with the network.

[0004] Layer 6, the presentation layer, includes protocols that are part of the operating system, and defines how information is formatted for display or printing and how data is encrypted, and translation of other character sets.

[0005] Layer 5, the session layer, coordinates communication between systems, maintaining sessions for as long as needed and performing security, logging, and administrative functions.

[0006] Layer 4, the transport layer, controls the movement of data between systems, defines protocols for structuring messages, and supervises the validity of transmissions by performing error checking.

[0007] Layer 3, the network layer, defines protocols for routing data by opening and maintaining a path on the network between systems to ensure that data arrives at the correct destination node.

[0008] Layer 2, the data-link layer, defines the rules for sending and receiving information from one node to another between systems.

[0009] Layer 1, the physical layer, governs hardware connections and byte-stream encoding for transmission. It is the only layer that involves a physical transfer of information between network nodes.

[0010] The lower two layers of the OSI model govern the physical link between systems. The main task of the data link layer is to take a raw transmission facility and transform it into a line that appears free of transmission errors in the network layer. It accomplishes this task by having the sender break the input data up into data frames (typically a few hundred bytes), transmit the frames sequentially, and process the acknowledgment frames sent back by the receiver. Since the physical layer merely accepts and transmits a stream of bits without any regard to meaning of structure, it is up to the data link layer to create and recognize frame boundaries. This can be accomplished by attaching special bit patterns to the beginning and end of the frame. If there is a chance that these bit patterns might occur in the data, special care must be taken to avoid confusion.

[0011] The final step in transmitting a message over the network is actually sending the message (and all the associated headers) over the physical connection. The binary data is transmitted using several methods: analog signals, amplitude or frequency modulation, light signals, radio signals or electromagnetic signals. The physical layer is concerned with transmitting raw bits over a communication

channel. The design issues have to do with making sure that when one side sends a 1 bit, it is received by the other side as a 1 bit, not as a 0 bit. Typical questions here are how many volts should be used to represent a 1 and how many for a 0, how many microseconds a bit lasts, whether transmission may proceed simultaneously in both directions, how the initial connection is established and how it is torn down when both sides are finished, and how many pins the network connector has and what each pin is used for. The design issues here deal largely with mechanical, electrical, and procedural interfaces, and the physical transmission medium, which lies below the physical layer.

[0012] The IEEE 802 committee has established the standards that have driven the LAN industry for the past two decades, including 802.3 Ethernet, 802.5 Token Ring, and 802.3z 100BASE-T Fast Ethernet. In 1997, after seven years of work, the IEEE published 802.11, the first internationally sanctioned standard for wireless LANs. In September 1999 the IEEE ratified the 802.11b "High Rate" amendment to the standard, which added two higher speeds (5.5 and 11 Mbps) to 802.11. The 802.11b specification affects only the physical layer, adding higher data rates and more robust connectivity. The standards-based technology allows administrators to build networks that seamlessly combine more than one LAN technology to best fit their business and user needs.

[0013] Like all IEEE 802 standards, the 802.11 standards focus on the bottom two levels of the ISO model, the physical layer and data link layer. The data link layer within 802.11 consists of two sublayers: Logical Link Control (LLC) and Media Access Control (MAC). 802.11 uses the same 802.2 LLC and 48-bit addressing as other 802 LANs, allowing for very simple bridging from wireless to IEEE wired networks. The MAC, however, is unique to wireless local area networks (WLANs). The 802.11 MAC is very similar in concept to 802.3, in that it is designed to support multiple users on a shared medium by having the sender sense the medium before accessing it. For 802.3 Ethernet LANs, the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol regulates how Ethernet stations establish access to the wire and how they detect and handle collisions that occur when two or more devices try to simultaneously communicate over the LAN. In an 802.11 WLAN, collision detection is not possible due to what is known as the "near/far" problem: to detect a collision, a station must be able to transmit and listen at the same time, but in radio systems the transmission drowns out the ability of the station to "hear" a collision. To account for this difference, 802.11 uses a slightly modified protocol known as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) or the Distributed Coordination Function (DCF). CSMA/CA attempts to avoid collisions by using explicit packet acknowledgment (ACK), which means an ACK packet is sent by the receiving station to confirm that the data packet arrived intact.

[0014] CSMA/CA works as follows. A station wishing to transmit senses the air, and, if no activity is detected, the station waits an additional, randomly selected period of time and then transmits if the medium is still free. If the packet is received intact, the receiving station issues an ACK frame that, once successfully received by the sender, completes the process. If the ACK frame is not detected by the sending station, either because the original data packet was not received intact or the ACK was not received intact, a